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Modification of Polysulfone for Proton Exchange Membranes

Mads M. Nielsen[1], *Ivaylo Dimitrov*[1], *Shogo Takamuku*[2], *Patric Jannasch*[2], *Katja Jankova*[1], *Søren Hvilsted*[1]

[1]*Department of Chemical and Biochemical Engineering, Danish Polymer Centre, Technical University of Denmark, Soltofts Plads 227, DK-2800 Kgs. Lyngby, Denmark*

[2]*Division of Polymer and Materials Chemistry, Lund University, P. O. Box 124, SE-221 00 Lund, Sweden*

mon@kt.dtu.dk; Tel.: +45 4525 6817; Fax: +45 4588 2161

The main hurdles on the field of Proton Exchange Membranes (PEM) in fuel cells (FC) are to obtain better durability, and improved performance at >80 °C at a reduced cost[1]. The proton conductivity of state-of-the-art perfluorosulfonic acid (PFSA) type membranes like Nafion® generally decays at higher temperatures, where the PEMFC system is more beneficial[2]. An alternative backbone is the commercially polysulfone (PSU) Udel® with good chemical, thermal and mechanical as well as film forming properties - the latter is a feature that easily rules otherwise strong candidates out[3]. Introduction of sulfonic acid groups in PSU is performed by "click" chemistry or through grafting by Atom Transfer Radical Polymerization (ATRP) from a short spacer, expected to contribute to the segregation onto hydrophobic and hydrophilic domains. By combination of well defined precursor backbones with the quantitative "click" chemistry and the controlled ATRP the Ion Exchange Capacity (IEC) can be tuned.

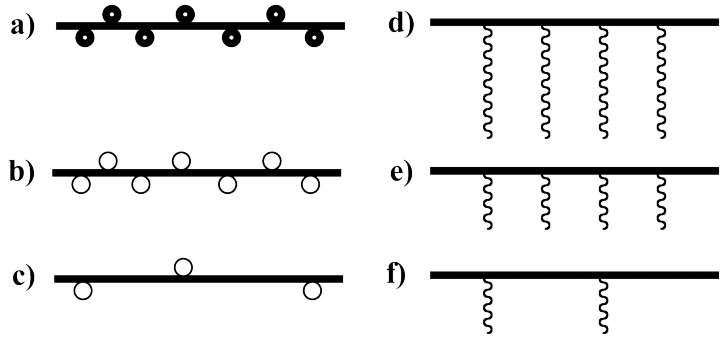

Figure 1. The pursued ways to modify the PSU backbone: "clicking" two different small molecules onto the backbone at the same number of sites, (a-b) or at a different amount of sites (c) - or by ATRP of the same monomer to different chain lengths (d-e) and from a different macroinitiator (f).

References:

[1] Y. Wang, K. S. Chen, J. Mishler, S. C. Cho, X. C. Adroher *Appl. Energ.* **88** (2011) 981-1007

[2] J. A. Mader, B. C. Benicewicz *Macromolecules* **43** (2010) 6706-6715

[3] I. Dimitrov, K. Jankova, S. Hvilsted *J. Polym. Sci. Part A: Polym. Chem* **46** (2008) 7827-7834; **48** (2010) 2044-2052